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# *MEASUREMENTS OF BLACK CARBON PARTICLES' CHEMICAL, PHYSICAL, AND OPTICAL PROPERTIES*


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## ABSTRACT

Accurate measurements of the chemical, physical, and optical properties of aerosol particles containing black carbon are necessary to improve current estimates of the radiative forcing in the atmosphere. A collaborative research effort between Aerodyne Research, Inc. and Boston College has focused on conducting field and laboratory experiments on carbonaceous particles and the development and characterization of new particulate instrumentation. This presentation will focus on the chemical, physical, and optical properties of black carbon particles measured in the laboratory in order to understand the effects of atmospheric processing on black carbon particles. Results from a three-week study during July 2008 of mass- and optical-based black carbon measurements will be presented. The project utilized the Boston College laboratory flame apparatus and aerosol conditioning and characterization equipment. A pre-mixed flat flame burner operating at controlled fuel–to-air ratios produced stable and reproducible concentrations of soot particles with known sizes, morphologies, and chemical compositions. In addition, other black carbon particle types, including fullerene soot, glassy carbon spheres, oxidized flame soot, Regal black, and Aquadag, were also atomized, size selected, and sampled.

The study covered an experimental matrix that systematically selected particle mobility size (30 to 300 nm) and black carbon particle mass, particle number concentration, particle shape (dynamic shape factor and fractal dimension), and particle chemistry and density (changed via coatings). Particles were coated with a measured thickness (few nm to ~150 nm) of sulfuric acid or bis (2-ethylhexyl) sebacate and passed through a thermal denuder to remove the coatings. Highlights of the study to be presented include: (1) Characterization of the chemical and physical properties of various types of black carbon particles, (2) Mass specific absorption measurements as a function of fuel-to-air ratio and carbon particle type, (3) Optical absorption enhancement measurements as a function of coatings, and (4) Particle shape determination as a function of fuel-to-air ratio and collapse observed due to coatings.